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Practitioner's Docket No. VR2-002

CHAPTER II

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/NL95-00153	27 April 1995 (27.04.95)	27 April 1995 (27.04.95)

TITLE OF INVENTION

Plastic-Based Composite Product and Method and Apparatus for Manufacturing

APPLICANT(S)

Avilplast B.V.

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231

ATTENTION: EO/US

NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.

CERTIFICATION UNDER 37 C.F.R. § 1.10*
(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date _____, in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL169834069, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Tami R. Tanaka

(type or print name of person mailing paper)

Tami R. Tanaka

Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

"WARNING: *Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*
*"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

EL169834069

WARNING: *Where the items are those which can be submitted to complete the entry of the international application into the national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C.F.R. § 1.8.*

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 U.S.C. § 371 otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

I. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. § 371:

a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).

b. ☒ The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
☐*	TOTAL CLAIMS	30 −20=	10	× $22.00=	$ 220
	INDEPENDENT CLAIMS	1 −3=	0	× $82.00=	0
	MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	
BASIC FEE**	☐ U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: ☐ and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(1) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) ..... $98.00 ☐ and the above requirements are not met (37 CFR 1.492(a)(1)) ..... $720.00 ☒ U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: ☐ has been paid (37 CFR 1.492(a)(2)) ..... $790.00 ☒ has not been paid (37 CFR 1.492(a)(3)) ..... $1,070.00 ☐ where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) $930.00				1,070
	Total of above Calculations				= 1,290
SMALL ENTITY	Reduction by 1/2 for filing by small entity, if applicable. Affidavit must be filed also. (note 37 CFR 1.9, 1.27, 1.28)				−
	Subtotal				1,290
	Total National Fee				$ 1,290
	Fee for recording the enclosed assignment document $40.00 (37 CFR 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				40
TOTAL	Total Fees enclosed				$ 1,330

*See attached Preliminary Amendment Reducing the Number of Claims.

i. ☒ A check in the amount of $1,330 to cover the above fees is enclosed.

ii. ☐ Please charge Account No. _____ in the amount of $ _____. A duplicate copy of this sheet is enclosed.

***WARNING:** *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

3. ☒ A copy of the International application as filed (35 U.S.C. § 371(c)(2)):

NOTE: Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment. "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

a. ☐ is transmitted herewith.

b. ☐ is not required, as the application was filed with the United States Receiving Office.

c. ☒ has been transmitted

i. ☒ by the International Bureau.
Date of mailing of the application (from form PCT/1B/308): _____.

ii. ☐ by applicant on _____.
Date

4. ☒ A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):

a. ☒ is transmitted herewith.

b. ☐ is not required as the application was filed in English.

c. ☐ was previously transmitted by applicant on _____.
Date

d. ☐ will follow.

5. ☒ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3)):

NOTE: *The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.*

a. ☐ are transmitted herewith.

b. ☒ have been transmitted

i. ☒ by the International Bureau.
Date of mailing of the amendment (from form PCT/1B/308): _____.

ii. ☐ by applicant on (date) _____.
Date

c. ☐ have not been transmitted as

i. ☐ applicant chose not to make amendments under PCT Article 19.
Date of mailing of Search Report (from form PCT/ISA/210.): _____.

ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. ☒ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. § 371(c)(3)):

a. ☐ is transmitted herewith.

b. ☒ is not required as the amendments were made in the English language.

c. ☐ has not been transmitted for reasons indicated at point 5(c) above.

7. ☒ A copy of the international examination report (PCT/IPEA/409)

☒ is transmitted herewith.

☐ is not required as the application was filed with the United States Receiving Office.

8. ☐ Annex(es) to the international preliminary examination report

a. ☐ is/are transmitted herewith.

b. ☐ is/are not required as the application was filed with the United States Receiving Office.

9. ☐ A translation of the annexes to the international preliminary examination report

a. ☐ is transmitted herewith.

b. ☐ is not required as the annexes are in the English language.

10. ☒ An oath or declaration of the inventor (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115

a. ☐ was previously submitted by applicant on _____. Date

b. ☒ is submitted herewith, and such oath or declaration

i. ☐ is attached to the application.

ii. ☒ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. § 1.70.

iii. ☐ will follow.

II. Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

a. ☒ is transmitted herewith.

b. ☐ has been transmitted by the International Bureau. Date of mailing (from form PCT/IB/308): _____.

c. ☐ is not required, as the application was searched by the United States International Searching Authority.

d. ☐ will be transmitted promptly upon request.

e. ☐ has been submitted by applicant on _____. Date

12. ☒ An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:

a. ☒ is transmitted herewith.

Also transmitted herewith is/are:

☒ Form PTO-1449 (PTO/SB/08A and 08B).

☒ Copies of citations listed.

b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).

c. ☐ was previously submitted by applicant on _____. Date

13. ☒ An assignment document is transmitted herewith for recording.

A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☒ FORM PTO 1595 is also attached.

_____

_____

_____

14. ☒ Additional documents:

a. ☐ Copy of request (PCT/RO/101)

b. ☒ International Publication No. WO 96/34045

i. ☒ Specification, claims and drawing

ii. ☐ Front page only

c. ☒ Preliminary amendment (37 C.F.R. § 1.121)

d. ☒ Other

Return Postcard Receipt; Petition for Revival of an International Application-Unintentional; Terminal Disclaimer; Check for $1,430 for Petition & Disclaimer Fees.

15. ☒ The above checked items are being transmitted

a. ☐ before 30 months from any claimed priority date.

b. ☒ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____, namely:

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependant claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 23-0925.

☒ 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 CFR § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

☒ 37 C.F.R. § 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☒ 37 C.F.R. § 1.17 (application processing fees)

☒ 37 C.F.R. § 1.17(a)(1)–(5) (extension fees pursuant to § 1.136(a).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☒ 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

SIGNATURE OF PRACTITIONER

Reg. No.: 33,560

Deepak Malhotra

(type or print name of practitioner)

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
TO THE UNITED STATES ELECTED OFFICE
UNDER THE PATENT COOPERATION TREATY

INTERNATIONAL APPLICATION NO. PCT/NL95/00153
INTERNATIONAL FILING DATE ..... 27 April 1995 (27.04.95)
INTERNATIONAL PRIORITY DATE ..... 27 April 1995 (27.04.95)
APPLICANT ..... Aviplast B.V.
ATTORNEY'S DOCKET NO. VR2-002
TITLE: Plastic-Based Composite Product and Method and Apparatus for Manufacturing Same

PRELIMINARY AMENDMENT

To: Box PCT
Assistant Commissioner for Patents
Washington, D.C. 20231
ATTN: EO/US

From: Deepak Malhotra, (509) 624-4276; (509) 838-3424 Fax
Wells, St. John, Roberts, Gregory & Matkin, P.S.
601 W. First Avenue, Suite 1300
Spokane, WA 99201-3817

In the Claims

Please amend the claims as follows.

Claim 4, line 1, change "2 or 3" to --2--.

Claim 5, line 1, delete "one of the preceding claims 2"

Claim 5, line 2, replace "- 4" with --claim 2--.

Claim 6, line 1, delete "one of the preceding claims 2"

Claim 6, line 2, replace "- 5" with --claim 2--.

Claim 7, line 1, delete "one of the preceding claims 2"

Claim 7, line 2, replace "- 6" with --claim 2--.

Claim 14, line 1, replace "any of the foregoing claims" with --claim 2--.

Claim 18, line 1, delete "any of the foregoing"

Claim 18, line 2, replace "claims" with --claim 2--.

Claim 20, line 2, replace "any of the foregoing claims" with --claim 2--.

Claim 25, line 1, replace "any of the claims 20-24" with --claim 20--.

Claim 27, line 1, replace "any of the claims 20-26" with --claim 20--.

Claim 28, line 2, replace "any of the claims 1-17" with --claim 1--.

REMARKS

This preliminary amendment merely removes multiple dependencies. Entry of this preliminary amendment prior to calculating the filing fee is requested.

Respectively submitted,

Date: October 27, 1998

By: Deepak Malhotra

MALHOTRA, Deepak
Reg. No. 33,560

PLASTIC-BASED COMPOSITE PRODUCT AND METHOD AND APPARATUS FOR MANUFACTURING SAME

The invention relates to a plastic-based composite product which consists at least partially of a plastic in which a material consisting substantially of particles is homogeneously embedded, which particles have tensile strength in at least one principal direction.

It is an object of the invention to provide a product which can be manufactured at low cost but which nevertheless meets high standards which may be required in respect of diverse properties. Such properties can relate for instance to mechanical properties, fire resistance, weather resistance, non-ageing properties and the like.

With a view to the above, the invention provides a product of the stated type which has the special feature that the particles comprise:

small particles, in particular plates or fibres with a random orientation and a length of 0.2-2 mm; and

large particles with a dominant orientation, for instance 80-95%, of the said principal direction of the particles in a chosen product principal direction and a length in the particle principal direction of about 2-6 mm.

A specific embodiment has the characteristic that the large particles comprise plates and the particle principal direction extends in the main plane thereof.

In order to easily obtain the desired orientation of the plates the embodiment is recommended wherein the plates have an at least more or less isotropic tensile strength in their main plane.

Very suitable in this latter context is the variant wherein the plates consist substantially of mica.

It is noted that according to the invention the particles can also possess a generally elongate form, whereby they may be designated as fibres.

A specific and very advantageous variant has the feature that the particles consist predominantly of wood

material and the plastic is a thermoplastic polymer material, in particular at least one polyolefin or one polymer on a basis of styrene, wherein

a. the transverse dimension of the large wood particles is preferably such that the ratio of the length in the principal direction of the particles to this transverse dimension amounts to a minimum of 4, but preferably lies in the range of 6-80.

b. the wood particles are present in a quantity of 40-80% by mass, but preferably from 50 to 70% by mass in relation to the mass of product.

c. the obtained product complies minimally with the following requirements relating to mechanical properties in

- bending strength in the fibre direction:8 MPa
- bending modulus in the fibre direction:3 GPa
- tensile strength in the fibre direction:6 MPa
- tensile stress modulus in fibre direction:3 GPa
- tensile strength transversely of fibre direction: 0.3 MPa
- tensile stress modulus transversely of fibre direction: 1GPa.

The invention herewith provides a product which in the manner to be described hereinbelow can be manufactured on a basis of wood without waste and, if desired, as a continuous process, which product not only possesses mechanical and physical/chemical properties corresponding with wood but which product can be manufactured on the basis of basic wood which can if desired be inferior and can be classified as interior wood, exterior wood or construction wood. This product according to the invention will hereinafter be designated as technical wood.

The invention provides the possibility of applying the obtained product at locations where tropical hardwood is still indicated.

For this purpose particles with tensile strength such as wood particles, preferably originating from waste wood or wood waste, optionally together with suitable strengthening particles, are predominantly oriented and bound by means of a thermoplastic polymer, preferably on a basis of olefins or styrene, wherein the proportion of applied particles is extreme

relative to the binder polymer such that there is no question of this being a fibre-filled thermoplastic material but an exceptionally wood-like material which can be processed in a manner usual for an expert.

It is important that the method can be performed continuously and comprises the stages of compressing, compounding, fibre-orienting and shaping, wherein the following requirements must be fulfilled.

1. the compression stage wherein expulsion of included gases, both inter- and intrafibular, must likewise take place under conditions wherein the fibres remain intact.
2. the compounding phase wherein the mixing of components and wetting with polymer melt must take place under conditions wherein fibres sensitive to breakage and splitting remain intact.
3. the orienting phase wherein a dominant orientation of long particles in the compressed plastic material must take place under conditions such that the mutual position of the particles in the mix is by and large retained, that is, the orientation proceeds along fluent flow lines, gradually and without such high shear stresses that there would thereby be a danger of thermal degradation.
4. the shaping phase wherein the mix acquires its fixed shape and dimensioning on the cross section perpendicularly of the flow direction, likewise under conditions wherein the relative mutual position of the particles remains practically unchanged, for which purpose the material flows under overpressure out of the mould head and remains at pressure in the calibrating unit until the binding polymer phase has cooled to below the Vicat softening temperature.

There is no extrusion here, since in extrusion the melted mass, after leaving the extrusion head, is relatively pressureless or is at least under a relatively small overpressure such as is necessary to allow an after-flow of the plastic core of the shaped product in the calibrating unit in order to thus enable replenishing of the material deficit resulting from shrinkage. This after-flow must always be

avoided because it would be accompanied by delamination and a decrease in cohesion between particles and plastic and the desired properties would consequently not be obtained.

There is also no question of pulltrusion since tensile forces are therein exerted on the shaped product after and in the final part of the consolidation phase for the purpose of continuous discharge of the shaped product, which otherwise acquires its shape in pressureless manner or under relatively small overpressure from a fusing of thermoplastic and fibre reinforcement.

The method according to the invention involves a shaping process under continuous significant overpressure, wherein the material does not flow but is pushed forward as a plastic plug through orientation, shaping and consolidation phase.

This method is therefore designated with the name of pushtrusion.

The obtained product on the basis of wood particles and plastic, technical wood, is fully recyclable due to the fibre binding by means of a thermoplastic. It will be apparent that recycled polyolefins and styrenes can also be used as fibre binder.

Additives can moreover be added during the compounding phase, whereby properties are given to the technical wood which surpass those of natural wood, particularly when fast-growers such as firs, pines, birches and poplars are used as starting point.

The method as continuous process will be designated as compushtrusion and the apparatus in which the method is performed will be designated compushtruder.

Examples are known from the patent literature wherein plastic products resembling wood are manufactured but wherein the mechanical properties as obtained according to the method of the invention are not obtained therein.

The known methods, insofar as a relatively high proportion of wood mass is processed into the product, moreover make use without exception of a machine with a strong kneading action, such as for instance the Banbury mixer or the Buss

Co-kneader, which is deliberately not used in the new method in respect of the harmful effect of such a kneading machine on the dimensions and properties of the applied wood fibres.

The applications of the products according to the known methods are limited to ornamentation, covering, fence palings etc., wherein the wood part is considered as filler:

EP-A-0 114 409, E.I. Du Pont de Nemours, 1994
US-A-5 030 662, A.K. Banerjie, 1991
US-A-4 866 110, Chang Y. Lee, 1989
US-A-5 082 605, J.G. Brooks et al, 1992
NL-A-77 04265, Lankhorst Touwfabrieken, 1978
WO-A-90/08020, Polywood Patent AB, 1990.

Description of the construction of the compushtruder.

On the compushtruder can be distinguished:

(1) compounder: preferably twin-screw or single-screw with adapted screw geometry,
(2) rotating displacement pump, preferably toothed wheel, plunger or screw,
(3) distribution head
(4) orienting means,
(5) mould head, also calibrating device,

which parts are further described hereinafter.

(1) Compounder.

The function of the compounder, as for instance from the series Theysohn TSK-N, Leistritz ZSE-GL, is to encapsulate particles, in particular wood fibres, in the liquid thermoplastic. This must take place such that the wood fibre is completely enclosed with polymer, however without the fibres effectively being shortened herein through breaking in the length. The wood fibres may however split longitudinally. This situation is achieved by the polymer melt wetting the fibres. Due to the relatively strong adhesion properties of the melt in relation to the fibres the latter are carried along and dispersed homogeneously further on in the melt phase. Adapting

the screw geometry prevents too intensive a kneading action being applied to the mixture, as is usually the case with for instance the Banbury mixer or a standard compounder. A conscious choice has been made for a long compounding path instead of a short sharp one, wherein the wood particles are handled carefully while a homogeneous dispersion nevertheless occurs. The wood particles are preferably introduced under compression and compacted to prevent excess air inclusion which could affect the quality of the end product.

By successively compressing, decompressing and degassing under vacuum the mixtures by means of the chosen screw geometry, air and gases are expelled, both from the mixture and from the pores in the fibres. In the case of a single-screw compounder the mixture is driven in a compressed plug flow, whereafter the thermoplastic part is melted.

The adhesion between wood particles and polymer melt is so great and adheres such that optional further additions can be made to the mixture without breaking the adhesion between polymer and wood particles.

Optional reinforcing fibres on a basis of cellulose, such as flax, hemp or mineral fibres of glass, (mica) plates or the like can be carried along in the above path.

The pressure on the mixture for the purpose of the shaping phase is not provided, as is usual, by the principle of the extruding action of the screw but by a rotating displacement pump interposed for this purpose.

(2) Rotating displacement pump

The pressure required to press the mixture through the distribution head (to be described below), the orienting means and the mould head/calibrating device is produced by a displacement pump, preferably a screw pump of a gear pump, for example Maag, Expac type Estrex 56/56 or Witte type ESTHF 92.6 LKK. High pressures can be realized without any significant effect on particle shape and dimensions. Moreover, since large shearing forces are practically absent, the desired pressure increase can be realized without excessive thermal load and degradation of the mixture.

(3) Distribution head

The distribution head is a necessary "interface" between rotating displacement pump and orienting means. The laminar flow pattern from the rotating displacement pump must be converted to a plug flow.

The particle orienting means must be supplied with a constant flow of mixture which in quantity and speed is distributed equally over the flow surface of the orienting means, this in order to prevent blockage and turbulence as result of speed differences after each phase of the particle orientation. The distribution head thus initiates the required placidity within the flow profile. The plug flow can be optimalized:

* mechanically by varying the through-flow surface per channel using adjustment bolts which can be accessed from outside and/or
* thermally by varying the flow resistance per channel using heating elements.

The form of the distribution head depends partly or wholly on the desired product.

(4) Orienting means

The orienting means consist of a plurality of plates connected in series with slits (in the case of plates) or (cylindrical) holes (in the case of fibres) in the flow direction. The total through-flow surface per plate is mutually equal. The diameter of the holes decreases over the plates connected in series. The diameter and the decrease thereof over the plates depends on the particle dimensions and the desired degree of orientation. When short fibres with a length of 2 mm and an L/D ratio of 4 are guided through a hole of 2.5 mm, little or no orientation will occur.

If a long fibre with a length of 4 mm and an L/D ratio of 8 passes through the same hole, then orientation will occur.

The number of plates depends on the degree of uniformity in the fibre length, the L/D ratios thereof and the desired degree of orientation.

The length of the slits or cylindrical holes is preferably at least equal to the maximum linear particle dimension.

Transition plates between the hole plates with different diameters have of course the same through-flow surface as the hole plates.

(5) Mould head/calibrating device

In order to make a two-dimensionally shaped endless product from the "wood mixture" with the oriented particles a mould head and a calibrating device are necessary. In contrast to the typically used extrusion shaping process, mould head and calibrating device are constructed integrally in the compushtrusion process, since the pushtrudate may not be pulled or have pressure exerted thereon in lengthwise direction.

An essential condition for obtaining technical wood is that after shaping the mixture is cooled under pressure to below the Vicat softening temperature of the binder thermoplastic. This consolidation process is necessary to prevent delamination and matrix failure.

The system pressure is derived from the flow resistance between mixture and mould head/calibration.

In order to prevent delamination and matrix failure in the calibration the first part hereof is covered with a coating which substantially reduces the surface resistance to a value wherein no delamination and matrix failure occurs. The outer part of the product meanwhile cooled to below the Vicat softening temperature in the calibration provides matrix support of that part of the product, the material core, still lying below the Vicat softening temperature.

Process parameters

It will be apparent that in the compushtrusion process many parameters can be distinguished which all have their influence on the creation, quality and properties of the technical wood.

The process parameters can be sub-divided as follows:

(1) Variable parameters, being adjustable parameters which can be varied on-line.

(2) Adaptable parameters are set once subject to the type of technical wood and the desired product section.

(1) Variable parameters

The variable parameters can be further sub-divided into two categories:

(1)a. as they also occur in the known compounding/extrusion process:

- temperatures, for instance set temperature profile of the screw cylinder, temperature of mould head,
- screw rotation speed,
- with twin-screw compounder: the filling level by means of dosaging,
- pressure, interactive,
- degassing, absolute pressure of the vacuum.

(1)b. new compushtrusion parameters:

- through-flow surface adjusted by means of adjustment bolts and/or temperature profile of the channels in the distribution head,
- temperature of the particle orienting provision,
- temperature of the calibration,
- rotating displacement pump temperature,
- rotating displacement pump pressure and output.

(2) Adaptable parameters

- screw geometry,
- manner and position of dosage,
- degassing zones and number,
- L/D ratio of the compushtruder,
- number of orientation plates,
- diameters and lengthwise change in the holes in the orientation plates,
- flow resistance in the mould head/calibrating device,

- position and active length of the resistance-reducing coating in the calibrating device.

Example of the method and the mechanical properties of obtained technical wood.

The method is performed in a compushtruder as described above with a capacity of 200 kg per hour.

The composition of the mixture is as follows:

- 60% by mass pinewood, length of the fibrous particles 0.6 - 3 mm,
  L/D = 4, moisture content 2.2% by mass
- 40% by mass polypropylene. MFI = 15 dg/min, (230/2,16)
- no other additions.

The most important process parameters are as follows:

- temperature profile in the range 160-195°C
- compounder feed pressure 15 bar
- rotating displacement pump pressure 95 bar
- vacuum 20 kPa.

Measured mechanical properties of the technical wood:

Six samples were measured wherein the following results were obtained in respect of the length orientation of the wood particles:

Tensile strength tests (ISO 527)		standard deviation	
Maximum tensile force	23.5 MPa	0.4	MPa
E-modulus	5.737 GPa	0.104	GPa
Tensile strength transversely of fibre direction	12.2 MPa	0.35	MPa
Tensile stress modulus transversely of fibre direction	2.122 GPa	0.102	GPa

Bending tests (ISO 178):

Maximum bending load	32.0 MPa	0.3 MPa
Bending modulus	3.849 GPa	0.098 GPa

Addition of 10% glass or flax fibre with a length of 4 mm and L/D 150 to 400 gives values about 25% higher than shown above.

A product can in principle be manufactured in any suitable manner, starting from pre-compounded material or semi-manufacture, for instance by (isostatic) pressing, injection moulding, extruding, compushtruding.

A specific embodiment has the feature that the product consists substantially of a laminate comprising a plastic-based composite layer according to the above stated specifications; a first skin layer adhered thereto on one side and possessing chosen properties; optionally a second skin layer adhered thereto on the other side and possessing chosen properties; and which layers are mutually adhered by for instance glueing, welding, mirror-welding, with an infrared laser, with hot air or other suitable treatment.

Another embodiment is characterized by at least one additive for obtaining desired properties, which additive is added to the process flow at a suitable position in the compushtruding process during manufacture of the product.

The said chosen properties of the skin layers may relate for instance to the adherability of paint, lacquer and glue.

A variant of this latter embodiment has the feature that the skin layer or at least one of the skin layers is of the type according to the invention and the long particle orientation thereof has a chosen direction relative to this orientation of the first mentioned plastic layer. Specific mechanical properties can hereby be achieved. These can be based for instance on the Stringer effect.

As already noted, the product according to the invention lends itself very well for manufacture by means of a process which can best be described as compushtrusion. In this respect the invention likewise provides a compushtrusion apparatus for manufacturing a product of the above specified type, which apparatus comprises: a compounder operating at low pressure for plasticizing a mixture consisting substantially of plastic and particles with tensile strength, which particles are mixed with the plastic either beforehand or in the compounder, and pressing the plastic mixture to the outside via an outlet;

a rotating displacement pump further transporting the plastic mixture;

a distribution head further guiding the mixture in order to further transport the plastic mixture substantially as a plug flow;

orienting means further guiding the mixture, comprising at least one bundle of substantially parallel channels through which the plastic mixture can flow and which are dimensioned relative to the long particles such that, other than to a dominating extent in the particle principal direction, they are too small to allow passage of the long particles present in the plastic mixture; and

a substantially prismatic mould head which connects onto the outlets of the channels and the form of which corresponds with the desired cross sectional form of the product;

such that the principal direction of the particles corresponds with the longitudinal direction of the mould head and the principal direction of the product;

which mould head is so long and has a temperature curve in the longitudinal direction such that at the end of the mouth the product has cooled to below its Vicat softening temperature.

As already discussed, the adhesion of lacquer, paint and glue can be enhanced by mechanical means, for instance due to a certain porosity and protruding fibres. Another embodiment which achieves the same effect in

chemo-physical manner is characterized by an additive with a desired influence on chosen properties of the product and belonging to at least one of the following classes:

- influencers of adhesion between particles with tensile strength and matrix polymer (class H),
- influencers of the properties of the surface of the product, particularly in respect of coatings or adhesives for applying in sandwich structures (class O),
- influencers of the pyrogenic properties (class P),
- influencers of the particle durability (class D),
- blowing means for obtaining a foamed structure (class B), in the case of a sufficiently high temperature increase.

The invention will now be elucidated with reference to the annexed drawings, wherein:

Figure 1 shows a highly schematic, partly broken away perspective side view of a compushtrusion apparatus with which a product according to the invention can be manufactured;

Figure 2 shows a highly schematic side view of an apparatus with which another product according to the invention can be manufactured;

Figure 3 is a cut away perspective view corresponding with figure 1 of a variant; and

Figure 4 is a cut away perspective view on enlarged scale of a part of the apparatus according to figure 3.

Figure 1 shows a compushtruder 1. This comprises a compounder 2, a rotating displacement pump 3, a distribution head 4, a particle orienting member 42 and a mould head/calibrating unit 43. The distribution head 4 and the orienting head 5 comprise continuous channels through which can pass the plasticized plastic, in which fibres with tensile strength are incorporated. The long fibres have a length predominantly in the range of 2-6 mm. In order to give these fibres the desired

orientation, that is, the longitudinal direction designated with arrow 6, the continuous channels comprise in the distribution head 4 and the orienting head 5 sub-channels having an effective diameter of for instance in the order of 6-8 mm, taking account of the wish to choose the diameter size of the said channels such that the orientation of the short fibres in not affected. It will be apparent that for other fibre lengths the said passages can be adapted correspondingly. The product 7 consists substantially of the solidified composite mass in which the long fibres extend generally at least roughly in longitudinal direction 6.

Figure 2 shows an alternative. Two compushtruders 8, 9 deliver products 10, 11 respectively in the direction of the pinch between two rollers 12, 13. At the position of the pinch 14 a plastic-impregnated fibre mat 15, comprising for instance glass or aramide fibres, is introduced between the plate-like products 10, 11 by transport rollers 16, 17. A laminate 18 is thus formed by heating and by the force exerted by rollers 12, 13. The fibres in the fibre mat 15 extend substantially in the longitudinal direction 6. At least one of the products 10, 11 displays a desired porosity in order to ensure properties corresponding with wood.

For greater thicknesses a product can be manufactured from a plurality of laminates placed one on top of another and mutually adhered by a thermal treatment and pressure.

It is further noted in general that binders can also be added to the basic plastic in order to improve the adhesion between fibres, plastic and other additives. The adhesion to the product according to the invention of paints and lacquers on acryl-water basis can hereby also improve.

The use of colouring agents or pigments in the mass can provide the advantage that a uniform product is obtained.

With reference to figure 2 attention is drawn to the fact that by making use of for example co-extrusion

or other suitable technique on the product according to the invention an additional coating can be applied to the visual side of the product. Such a coating can have an extra-stable colour, an increased UV-resistance or resistance to dirt and weather influences.

In contrast to the above mentioned prior art the invention provides a product which lends itself for processing and treating as wood. The following considerations are paramount here.

The product according to the invention can have a linear expansion similar to wood and also has a similar strength and stiffness with a comparatively great toughness and excellent cracking strength. The product can display fire characteristics which, by making use of environmentally-friendly provisions, must be at least the equal of the fire characteristics of normal wood and which when it burns may not produce any more smoke and harmful substances than normal wood. At a specific weight of 750-1250 kg/m^3, the process and the required raw materials and additives may not exceed the price of normally processed wood.

In terms of appearance and weight the product according to the invention can if desired display a striking similarity with natural wood or traditionally pressed wood such as MDF or wood fibre board.

The product according to the invention can be worked with normal tools and normal wood processing machines. In the usual manner of wood it can be nailed, sawn, screwed, glued, painted and lacquered.

The product according to the invention can possess an excellent resistance to climatological conditions such as moisture, sunlight with ultraviolet component, temperature changes etc.

The products according to the invention are better suitable for recycling after use than natural wood.

The products according to the invention are superior to wood in respect of moisture absorption, rotting, swelling and the like.

Figure 3 shows a compushtruder 21 which has a structure differing partially from that drawn in figure 1. A distribution head 23 connects onto the rotating displacement pump 3 (see also figure 4). This block has a more or less conically tapering inlet space 24 which debouches into a fan of nine channels 25-33. Figure 4 in particular shows clearly the internal structure of the distribution head 23. By means of screws controllable from outside, which are all designated 34 for the sake of convenience, the effective passage and therewith the flow resistance of channels 25-33 can be individually adjusted. An excellent homogeneity of the through-flowing mixture can hereby be ensured. Alternatively, the effective through-flow of the channels can be influenced by a selective heating. The through-flow of a channel can in any case be improved by reducing the flow resistance. This can be achieved not only by adjusting the passage but also by changing the temperature, whereby the viscosity of the through-flowing mixture changes, at least in the boundary surface, thereby changing the effective through-flow.

Via a collection space 35 the plastic mixture allowed through is fed to a bundle 36 of channels which is bounded by plates extending one on top of another in transverse direction. By means of channels 37 sufficient heat can be supplied to the through-flowing mixture to keep it in plastic state. A second bundle 38 follows the first bundle 36 via an interspace 37. A third bundle 40 follows via an interspace 39.

Downstream of this latter bundle 40 is situated the mould head 41 of the compushtruder 21. By means of calibrating and cooling means the product is then cooled gradually while a sufficient pressure is maintained, and is carried to the outside in the correct dimensions. Product 42 according to figure 3 has an orientation of the long fibres corresponding with the mould longitudinal direction.

The diameters of the mutually adjacent round

channels in bundles 36, 38, 40 amount in this embodiment to respectively 14 mm, 8 mm and 6 mm while retaining the same through-flow surface.

It will be apparent from the structure shown in figure 4 that the mass flowing through the more inwardly located channels has a smaller flow resistance than the mass flowing through the more outwardly located channels, since they are longer. In this context the more inwardly located channels can have a slightly smaller diameter.

It is noted that in all compushtruders the mixture with the fibres embedded therein is introduced into the mould head by the rotating displacement pump at a relatively high temperature above the Vicat softening temperature, for instance 180°C, cools during the transport through the mould head and has reached a reduced temperature at the end such that the exiting product has a temperature below the Vicat softening temperature, whereby it is sufficiently cured that it will no longer undergo any substantial change in shape.

*****

CLAIMS

1. Plastic-based composite product which consists at least partially of a plastic in which a material consisting substantially of particles is homogeneously embedded, which particles have tensile strength in at least one principal direction,

characterized in that

the particle comprise:

small particles, in particular plates or fibres with a random orientation and a length of 0.2-2 mm; and

large particles with a dominant orientation, for instance 80-95%, of the said principal direction of the particles in a chosen product principal direction and a length in the particle principal direction of about 2-6 mm.

2. Product as claimed in claim 1,

characterized in that

the large particles are plates and the particle principal direction extends in the main plane thereof.

3. Product as claimed in claim 2,

characterized in that

the plates have an at least more or less isotropic tensile strength in their main plane.

4. Product as claimed in claim 3,

characterized in that

the plates consist substantially of mica.

5. Product as claimed in claim 1,

characterized in that

the large particles are fibres wherein the principal direction of the particles is the longitudinal direction of each fibre.

6. Product as claimed in claim 1,

characterized in that

the particles consist predominantly of wood material and the plastic is a thermoplastic polymer

material, in particular at least one polyolefin or one polymer on a basis of styrene,

wherein

a. the transverse dimension of the large wood particles is preferably such that the ratio between the length in the principal direction of the particles and this transverse dimension amounts to a minimum of 4, but preferably lies in the range of 6-80.

b. the wood particles are present in a quantity of 40-80% by mass, but preferably from 50 to 70% by mass in relation to the mass of product.

c. the obtained product complies minimally with the following requirements relating to mechanical properties in

- bending strength in the fibre direction:8 MPa
- bending modulus in the fibre direction:3 GPa
- tensile strength in the fibre direction: 6 MPa
- tensile stress modulus in fibre direction: 3 GPa
- tensile strength transversely of fibre direction: 0.3 MPa
- tensile stress modulus transversely of fibre direction: 1 GPa.

7. Product as claimed in claim 6,

characterized in that

the wood particles originate from softwood or hardwood, preferably one of the following types: fir, spruce, birch, poplar.

8. Product as claimed in claim 6,

characterized by

other particles with tensile strength of 3-25% by mass, preferably 5-18% by mass.

9. Product as claimed in claim 8,

characterized by

other particles with tensile strength which originate from at least one type of the class of inorganic polymers on a basis of silicates, preferably glass.

10. Product as claimed in claim 8,

characterized by

other fibres with tensile strength consisting of glass fibres, chopped strands with a length of 4-5 mm and a diameter of

0.013 mm and a ratio of length to diameter in the range of 300-400.

11. Product as claimed in claim 8,
characterized by
other fibres with tensile strength of one or more types of the class of the natural biopolymers on a basis of cellulose, preferably from flax, jute, hemp, sisal, coconut, bamboo and miscanthus, wherein the percentage applied also depends on the number of external appendages on the fibres.

12. Product as claimed in claim 6,
characterized in that
the polymer material consists of polypropylene, polystyrene, polyethylene or polyacrylate.

13. Product as claimed in claim 12,
characterized in that
the polymer material consists of one or more olefinic homo- or copolymerisates with an M.F.I. (230/2,16) of 1-30 dg/min; preferably 2-15 dg/min; and which polymeric matrix material forms 10-50% by mass and preferably 15-40% by mass of the technical wood.

14. Product as claimed in any of the foregoing claims,
characterized by
at least one additive for obtaining desired properties, which additive is added to the process flow at a suitable position in the compushtruding process during manufacture of the product.

15. Product as claimed in claim 14,
characterized by
an additive with a desired influence on chosen properties of the product and belonging to at least one of the following classes:

- influencers of adhesion between particles with tensile strength and matrix polymer (class H),
- influencers of the properties of the surface of the product, particularly in respect of coatings or adhesives for applying in sandwich structures (class O),
- influencers of the pyrogenic properties (class P),
- influencers of the particle durability (class D),

. blowing means for obtaining a foamed structure (class B), in the case of an unintended, sufficiently great temperature increase.

16. Product as claimed in claim 14,

characterized in that

as additives with a positive influence on the desired properties of the technical wood preferably one or more of the following are used, therein indicating the class or classes and the applied percentage related to the mass of technical wood:

Additive	Class	Mass-percentage
Polybond (Spider)	H O	1-3, preferably 2.5
Polyweb (DOW)	H O	1-3, preferably 2.5
Exxelor (Exxon)	H O	1-3, preferably 2.5
tributoxyethylphosphate	H O P	1-5, preferably 2
1,2,3-propane triol	H O V	2-3, preferably 2.5
diammoniumphosphate	P D	2-8
ammoniumcarbonate	P B	1-3
ammoniumhydrogencarbonate	P B	
1,2-ethane diol	O D	up to 3
ethylacetate/ethanol 1/2 -1/3	O	up to 3
methylacetate	H O	up to 4
n-propanol	O	up to 1.5
silane A 171, 172, 174	H O D	0.5 - 3
polyvinylacetate	H O D	up to 5
surfactants, ionogenic/aniogenic,		
standard	H O	up to 2
chlorinated polyolefins	H O	up to 5
UV-stabilizers	D	up to 3
azodicarbonamide	P B	up to 3

17. Product as claimed in any of the foregoing claims,

characterized in that

at least one colouring agent or pigment is added to the product during manufacture.

18. Product as claimed in any of the foregoing claims,

characterized in that

the product consists substantially of a laminate comprising:

a plastic-based composite layer as claimed in any of the foregoing claims;

a first skin layer adhered thereto on one side and possessing chosen properties;

optionally a second skin layer adhered thereto on the other side and possessing chosen properties; and which layers are mutually adhered by for instance glueing, welding, mirror-welding, with an infrared laser, with hot air or other suitable treatment.

19. Product as claimed in claim 18,

characterized in that

the skin layer or at least one of the skin layers is of the type as claimed in any of the foregoing claims and the product principal direction thereof has a chosen direction relative to this product principal direction of the first mentioned plastic-based composite layer.

20. Apparatus for manufacturing a product as claimed in any of the foregoing claims, comprising:

a compounder operating at low pressure for plasticizing a mixture consisting substantially of plastic and particles with tensile strength, which particles are mixed with the plastic either beforehand or in the compounder, and pressing the plastic mixture to the outside via an outlet;

a rotating displacement pump further transporting the plastic mixture;

a distribution head further guiding the mixture in order to further transport the plastic mixture substantially as a plug flow;

orienting means further guiding the mixture, comprising at least one bundle of substantially parallel channels through which the plastic mixture can flow, which channels are dimensioned relative to the long particles such that, other than to a dominating extent in

the particle principal direction, they are too small to allow passage of the long particles present in the plastic mixture; and

a substantially prismatic mould head which connects onto the outlets of the channels and the form of which corresponds with the desired cross sectional form of the product;

such that the particle principal direction corresponds with the longitudinal direction of the mould head and the product principal direction;

which mould head is so long and has a temperature curve in the longitudinal direction such that at the end of the mouth the product has cooled to below its Vicat softening temperature.

21. Apparatus as claimed in claim 20, wherein the linear transverse dimensions of at least the parts of the channels located furthest downstream amount to a minimum of 2x the length of the short fibres and a maximum of 1.5x the length of the long fibres.

22. Apparatus as claimed in claim 20, comprising at least two bundles of channels mutually connecting in series, wherein the transverse dimensions of the channels of a bundle located further downstream are smaller than those of the channels of a bundle located further upstream.

23. Apparatus as claimed in claim 20,

wherein the effective passages of the channels of the distribution head are adjustable, for instance by means of screws controllable from outside, or by means of selective heating.

24. Apparatus as claimed in claim 20,

wherein at least one feed for adding particle material and/or additives to the plastic connects to the compounder.

25. Apparatus as claimed in any of the claims 20-24, comprising particle supply means which are adapted to introduce the particles into the compounder under a pressure such that these are compressed while air is expelled.

26. Apparatus as claimed in claim 25, comprising compression means for compressing the particle material to expel gases such as air prior to addition of the plastic.

27. Apparatus as claimed in any of the claims 20-26, wherein the compounder has a screw with a geometry such that the plastic mixture in which the particles are incorporated is successively compressed, decompressed and degassed under vacuum such that air and other gases are expelled from the mixture and from the pores present in the particles.

28. Method for manufacturing a product as claimed in any of the claims 1-17,

characterized in that

the finished product is subjected to an after-treatment comprising of heating the product to a temperature above the Vicat softening temperature of the applied plastic respectively the highest Vicat softening temperature of all the applied plastics, modelling the product to a desired shape and while maintaining a chosen pressure causing the product to cool in this shape to below the said Vicat softening temperature.

29. Product obtained with the method as claimed in claim 28.

30. Method for manufacturing a product as claimed in claim 12,

characterized in that

as starting polymer material is used a prepolymer on the basis of a styrene or an acrylate.

*****

FIG.1

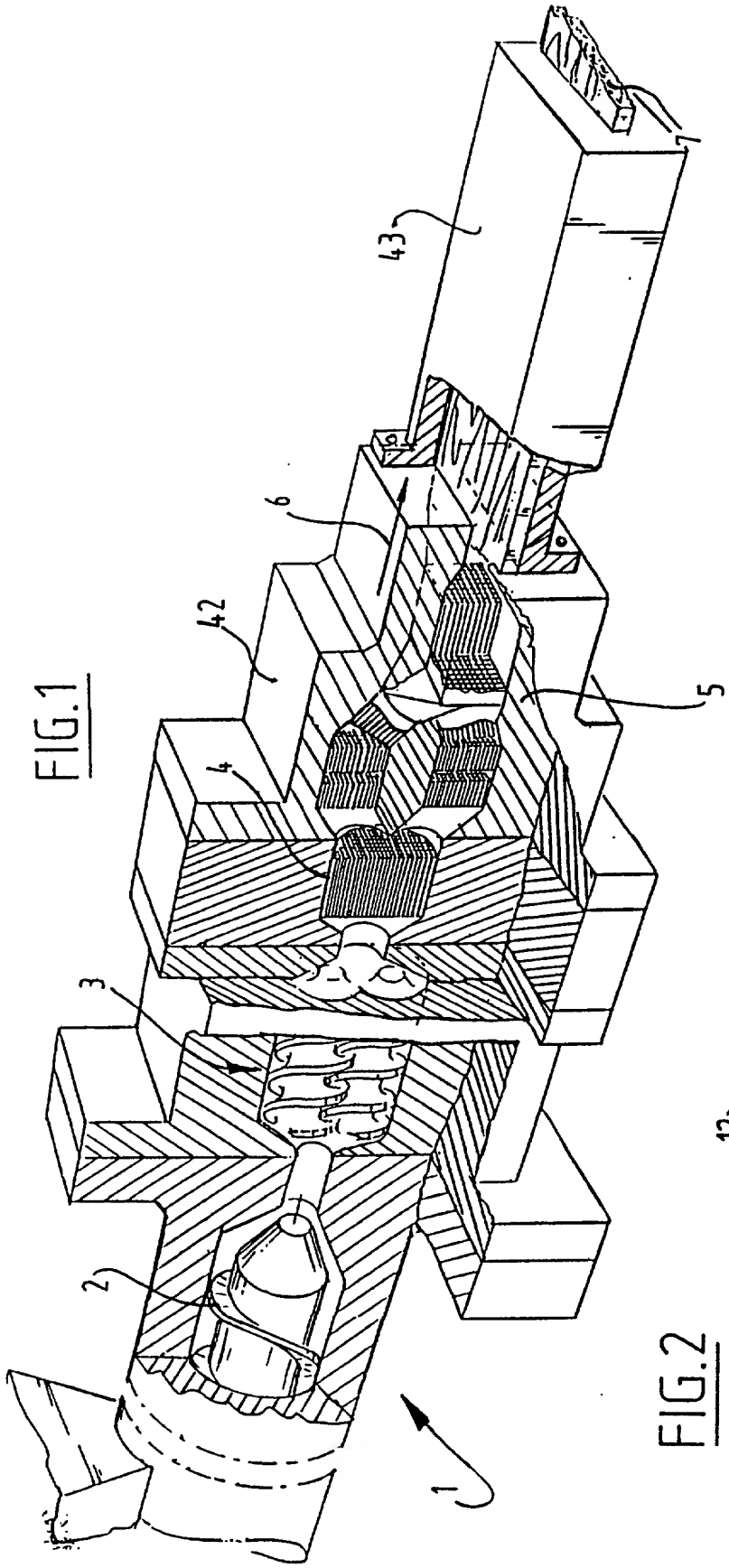
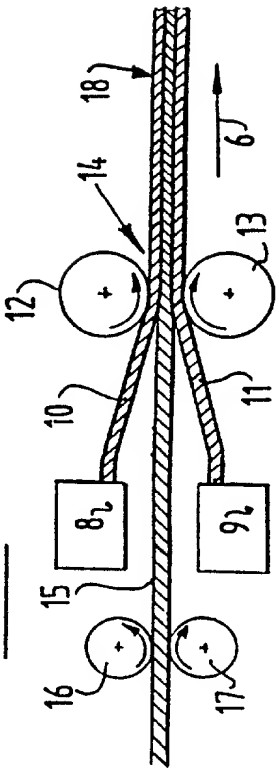


FIG.2



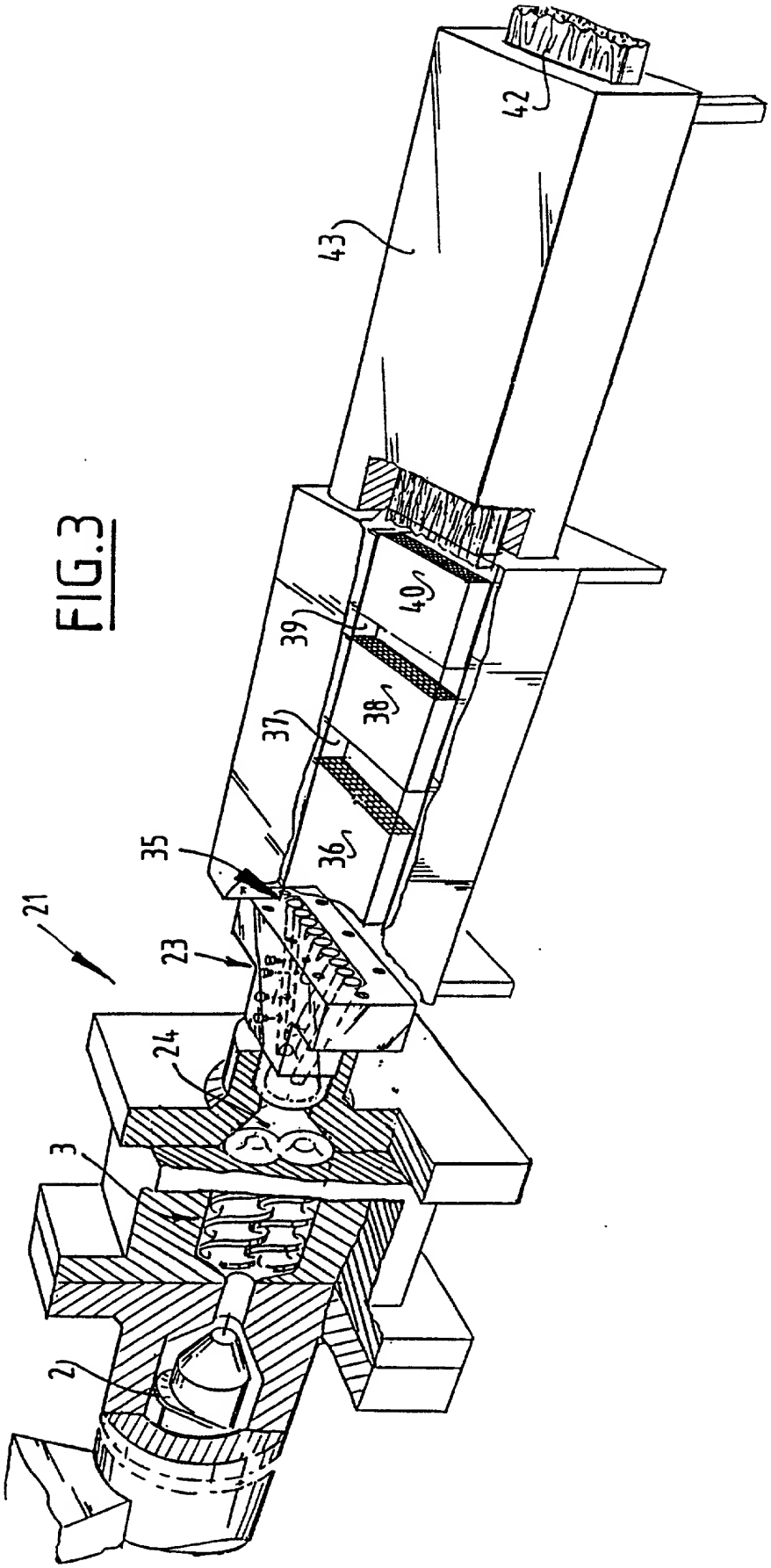


FIG.3

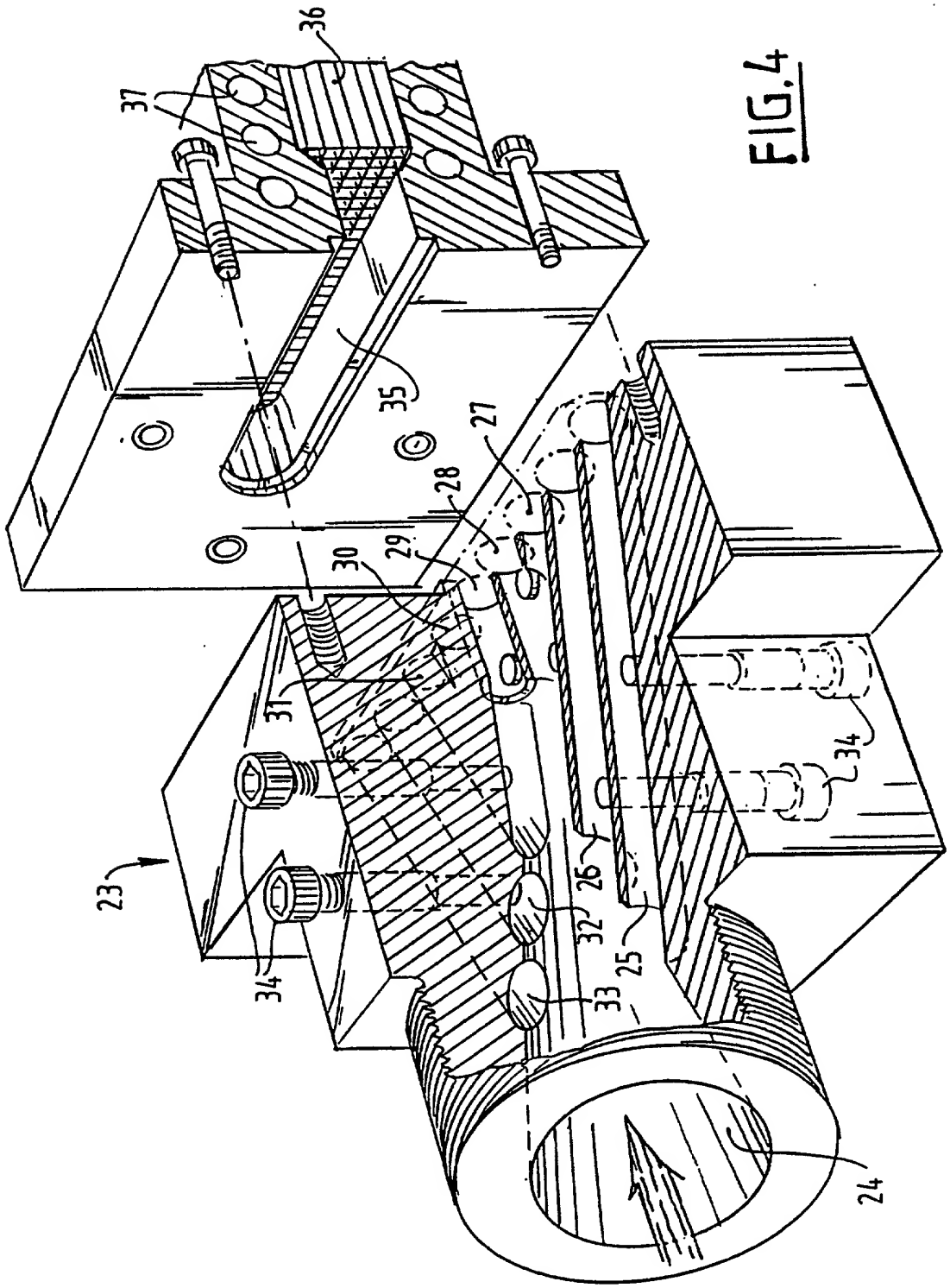


FIG.4

Declaration and Power of Attorney for Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **"Plastic-based Composite Product and Method and Apparatus For Manufacturing Same"** (Attorney Docket No.: **VR2-002**), the specification of which

(check one) [ ] is attached hereto.

[X] was filed, with my authority, on October 27, 1998
as Application Serial No. 09/171,910
and was amended on October 27, 1998 (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

And I hereby appoint RICHARD J. ST. JOHN, Reg. No. 19,363; DAVID P. ROBERTS, Reg. No. 23,032; RANDY A. GREGORY, Reg. No. 30,386; JAMES L. PRICE, Reg. No. 27,376; MARK S. MATKIN, Reg. No. 32,268; DEEPAK MALHOTRA, Reg. No. 33,560; MARK W. HENDRICKSEN, Reg. No. 32,356; DAVID G. LATWESEN; Reg. No. 38,533; GEORGE G. GRIGEL, Reg. No. 31,166; KEITH D. GRZELAK, Reg. No. 37,144; LANCE R. SADLER, Reg. No. 38,605; and JAMES D. SHAURETTE, Reg. No. 39,833, 601 West First Avenue, Suite 1300, Spokane, Washington 99201-3828, Telephone (509) 624-4276, and each or any of them, my attorneys or agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

ADDRESS ALL COMMUNICATIONS IN OR PERTAINING TO THIS APPLICATION TO:

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Spokane, WA 99201-3828

Foreign Application(s)

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

(Number)	(Country)	(Filing Date)	Priority Claimed
PCT/NL95/00153	PCT	27/04/1995	XX Yes No
			Yes No

U.S. Provisional Application(s)

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

(Provisional Application No.)	(Filing Date)
/	
/	

U.S. Patent Application(s)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, or abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

The undersigned to this Declaration and Power of Attorney hereby authorizes the U.S. attorneys named herein to accept and follow instructions from **Octrooibureau Vriesendorp & Gaade, Postbus 681, Apeldoorn, NL 7300 AR, THE NETHERLANDS**

[*Firm Name and Address*]

as to any actions to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys will be so notified by the undersigned.

Full name of sole or first joint inventor VAN DIJK, Dirk

1-00

Inventor's signature [signature] BENENDEN 29-03-99 Date

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